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Environmental change near the Barremian/Aptian boundary: the Rawil Member of the Swiss Helvetic Alps

M. Stein (1), T. Adatte (1), A. Arnaud-Vanneau (2), V. Matera (3), D. Fleitmann (4), N. Fiet (5), and K.B. Föllmi (1)

(1) Institute of Geology and Paleontology, University of Lausanne, Switzerland (melody.stein@unil.ch), (2) Institut Dolomieu, Grenoble, France, (3) Institute of Geology, University of Neuchâtel, Switzerland, (4) Institute of Geological Sciences, University of Bern, Switzerland, (5) AREVA, Paris, France.

In the helvetic realm representative of the northern Tethyan margin, the Late Barremian is characterized by the onset in the deposition of Urgonian-type, predominantly photozoan, shallow-water platform carbonates (lower Schrattenkalk member). During the earliest Aptian, the development of the Urgonian carbonate platform was perturbed by the deposition of the so-called "Lower Orbitolina Beds", which were baptized as Rawil Member in Switzerland. This member includes a shallow-water, marl- and sand-bearing succession containing wood fragments. These sediments are dominated by heterozoan carbonates.

We study the paleoenvironmental conditions, which led to the deposition of the Rawil Member, and sampled three representative outcrops (Lopper, Pilatus and Säntis) in the helvetic thrust-and-fold belt, in the northern part of the Alps. We measured phosphorus (P) contents, carbon-isotope compositions, trace-metal (TM) contents, clay assemblages, and established a detrital index (DI) based on XRD analyses on bulk rock. Preliminary results suggest that P contents in these three sections through the Rawil member are slightly enriched in P relative to the under- and overlying sediments of the Schrattenkalk Formation. We relate this increase to the important associated increase in detrital material (peaks in quartz percent, in DI and change in clay mineralogy). In the studied sections, a positive correlation can be seen between detrital influx, phosphorus concentrations and the occurrence of Orbitolinid rich beds.
With regards to the whole-rock stable-carbon isotope record, in the Lopper section, the lowest values appear in the top beds of the lower Schrattenkalk Member. We correlate this negative excursion of around -1‰ with an excursion established from sections in SE France and dated as latest Barremian. Based on this correlation, we confirm a latest Barremian age for the lower Schrattenkalk Member, whereas the onset of the Rawil Member dates as earliest Aptian. Further carbon-isotope analyses are underway in order to corroborate this correlation.
TM (V, Co, As, U, Mo) distributions show patterns similar to those displayed by aluminium and by the DI suggesting that TM contributions are related to detrital input under oxic conditions.

The study of faunal and floral assemblages contained within the sediments of the Rawil Member allows to characterize their paleocology and paleoenvironment. A quantification of the abundance and relative proportions of each microfossil group in thin section permits to evaluate even small changes and shifts in the paleoenvironment, which are otherwise less visible. Shifts in the paleoenvironment, which can be interpreted in terms of paleobathymetry are of interest in the establishment of sequence-stratigraphic schemes. For instance, shifts towards high percentages of species associated with maximal bathymetries may indicate the presence of a maximum flooding surface. By using this approach, we observe the presence of a sequence boundary (SbA1) at the base of the Rawil Member in the Lopper section which we interpret as the start of the first sequence of earliest Aptian age. SbA1 is followed by two intervals characterized by circumlittoral, deeper-water assemblages, which end by a maximum flooding surface.

In summary, the detrital influx, the slight enrichment in P, the presence and local abundance of orbitolinids suggest a depositional environment for the Rawil Member in a mesotrophic shallow-platform with intermittent high-energy conditions and episodes of increased detrital and nutrient input from the land.